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GLOSSARY OF TERMS RELATING TO IRON AND STEEL

PART VI FORGING (INCLUDING DROP FORGING)

(First Revision)

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GLOSSARY OF TERMS RELATING TO IRON AND STEEL

PART VI FORGING (INCLUDING DROP FORGING)

(First Revision)

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GLOSSARY OF TERMS RELATING TO IRON AND STEEL

PART VI FORGING (INCLUDING DROP FORGING)

(First Revision)

0. FOREWORD

0.1 This Indian Standard (Part VI) (First Revision) was adopted by the Indian Standards Institution on 21 May 1976, after the draft finalized by the Metal Standards Sectional Committee had been approved by the Structural and Metals Division Council.

0.2 This standard was first published in 1962. As a result of experience gained during these years, certain modifications have been made in some of the meanings of various terms. The Sectional Committee while issuing this revision felt it desirable to issue the standard in separate parts. Other parts of the standard are as follows:

Part I	General metallurgy, heat treatment and testing
Part II	Steel making
Part III	Hot-rolled steel products (excluding sheet and strip)
Part IV	Steel sheet and strip
Part V	Bright steel bar and steel wire
Part VII	Wrought iron
Part VIII	Steel tubes and pipes

0.3 This standard has been prepared to assist the manufacturers and the users in uniform interpretation of the common terms used in the iron and steel industry.

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1. SCOPE

1.1 This standard (Part VI) is intended to convey the meanings of the terms commonly used in the field of forging, including drop forging.

2. TERMINOLOGY

2.1 Bar — Finished product of solid section which may be rectangular, square, round, half-round or polygonal. The dimensions generally conform to the following (*see also* **2.1.1**):

Rounds and Half-Rounds — Minimum diameter 6 mm.

Squares and Polygonals — Minimum side 6 mm.

2.1.1 *Flat Bar* (*Flat*) — A finished product, generally of rectangular cross section, with edges of controlled contour and of thickness 3 mm and over and width 400 mm and below, supplied in straight lengths. The product shall have rolled edges only (square or slightly rounded). This group also includes flat bars with bulb that has swelling on one or two faces of the same edge and a width of less than 400 mm.

2.2 Bar Hold (Tong Hold) — The end of a bar or forging so reduced as to accommodate a porter bar or tongs for manipulation during forging.

2.3 Barrel — The part of a forging of a major cross section, the length of which usually exceeds the diameter.

2.4 Becking — Forging the wall of a steel ring, for example, steel tyre, between a top becking tool and a becking bar, to increase the internal diameter with or without an increase in the external diameter.

2.5 Becking Bar (Expanding Bar) — A round bar supported at both ends which forms the lower tool used for expanding or becking the hole in a hollow forging.

2.6 Becking Stand (Saddle) — One of the two supports for a becking bar.

2.7 Bender (Setter) — Device used in drop forging hammer dies to bring the several sections of the stock or prepared blank into alignment.

2.8 Billet — A semi-finished product obtained by forging, rolling or continuous casting, usually square and not exceeding 125 × 125 mm in cross section with rounded corners, and intended for further processing into suitable finished product by forging or re-rolling.

2.9 Blank — A cylindrical forging of diameter greater than length, from which such components as gear wheels and flywheels can be produced.

2.10 Blocking — Rough forging of the stock to the appropriate shape of the finished forging. This term is generally applicable to heavy forgings.

2.11 Bloom — A semi-finished forged, rolled or continuously cast product intended for re-rolling or forging. The cross section is square or rectangular (excluding slab) and is generally more than 125 × 125 mm (or equivalent cross-sectional area).

2.12 **Blow** — A surface defect caused by the vapour from an excess of lubricant on the dies.

2.13 **Bolster** — A dovetailed block of steel which rests on the base block of the hammer, into which the bottom die is keyed.

2.14 **Boss** — A projection on the surface of a forging.

2.15 **Bottling** — Reducing the diameter at the end of a hollow forging to form a neck.

2.16 **Box** — *See* 2.108.

2.17 **Burning** — Heating to such a high temperature that the properties of the material are permanently impaired by incipient fusion or oxide penetration.

2.18 **Cheese** — A roughly cylindrical forging with convex sides formed by upending ingot or billet lengths between flat tools.

2.19 **Chipping** — Removing surface defects by manual or pneumatic chisel.

2.20 **Chop** — A defect caused by metal being scraped from the side of the forging and hammered into the surface.

2.21 **Clink** — A crack either internal or external caused by uneven contraction or expansion during heating or cooling of steel,

2.22 **Clipping** (**Trimming**) — Removing the fash (*see also* 2.49 and 2.111).

2.23 **Closing** — Reducing the diameter of a tube, ring or hollow forging by pressing or hammering on a mandrel. The term has a special meaning in reference to boiler drum ends when being formed to give a semi-circular profile.

2.24 **Cogging** (**Hammer Cogging; Roughing**) — The action of reducing, by hot working, an ingot into a bloom or slab for subsequent rolling or forging.

2.25 **Coining** — Sizing a forging to close tolerances under a suitable press or hammer (*see also* 2.134).

2.26 **Collar** — Part of a forging having a diameter greater than the adjacent portions but of a length less than its diameter.

2.27 **Contraction Cavity** — *See* 2.105.

2.28 **Cropping** — Shearing off discard from the ends of an ingot, a bloom or a forged product prior to further working. End discard shearing of semi-finished or finished products is also called cropping (*see also* 2.37).

2.29 Cutoffs — A pair of blades either machined in the corner of the dies or inserted in the dies, used to cut away forging from the bar.

2.30 Descaling — Removal of surface scale from a hot worked or heat treated product by pickling, shot-blasting, etc. Also removal of scale during hot working by the application of water, coal dust, brushwood, oil, etc.

2.31 Deseaming (Scarfing) — The removal of surface defects from ingots or semi-finished products by an oxy-gas flame.

2.32 Die Face — The face of the dies in which the impression is cut.

2.33 Die Life — The number of forgings produced from dies before the impressions have worn beyond the permitted tolerances.

2.34 Die Line — *See* **2.100.**

2.35 Dies — Steel blocks into which the impressions are cut corresponding to the shape of the forgings to be produced.

2.36 Die Wear — The erosion of the die surfaces caused by the flow of plastic metal over them.

2.37 Discard — Those portions, corresponding to the top and bottom of the ingot, which are removed to ensure that the remainder of the material is of satisfactory quality. Also defective material produced in rolling or forging, to be cut from one or both ends of the semi-finished or finished product (*see also* **2.28**).

2.38 Dishing — Forming a cup or depression in a forging.

2.39 Draft or Draught (Draw; Leave; Taper) — The angle of taper on the side walls of the die impressions to permit the removal of the forging from the dies.

2.40 Draw — *See* **2.39.**

2.41 Drawing — Forging to produce a smaller cross-sectional area and therefore a greater length.

2.42 Drifting — Expanding a forging by driving in a tapered tool.

2.43 Drop Forging — An article produced by hot working the metal between closed dies by means of a falling weight as in a drop hammer, the operation involving a modification of both the form and section of the stock from which the forging is produced. It may also refer to the process followed in producing the article.

2.44 Dummy — That part of the die used for rough forming the stock before the final forging operation.

2.45 **Dummy Hammer** — A mechanically operated hammer used for drawing out or shaping the material prior to the final forging operation.

2.46 **Edger** — That part of the die used to distribute the metal in the proportion necessary to fill the die impression.

2.47 **Edging** — Rounding by forging an upended disc or cheese to form a blank. Also refers to spreading or stepping down a part of the stock.

2.48 **Expanding Bar** — *See* 2.5.

2.49 **Fash (Fin; Flash; Scrap)** — The ~~metal~~ in excess of that required to fill the die impression, which forms a thin plate between the die faces and is trimmed (clipped).

2.50 **Fast Tool** — A tool or die rigidly fixed to the hammer or press, to give a forging the required shape.

2.51 **Fast Tool Forging** — A forging made with fast tool.

2.52 **Fettling** — Removing the surface defects or excess material by grinding, chipping or filing.

2.53 **Fin** — *See* 2.49.

2.54 **Finishing Temperature** — The temperature at which hot working is completed.

2.55 **Flakes** — *See* 2.70.

2.56 **Flash** — *See* 2.49.

2.57 **Flash Line** — The line appearing around the profile of the forging after clipping.

2.58 **Flat** — *See* 2.1.1.

2.59 **Flat Bar** — *See* 2.1.1.

2.60 **Forgeability** — Ability to undergo plastic deformation by forging.

2.61 **Forging** — An article produced by hot working the metal under a hammer or press. It may also refer to the process followed in producing the article.

2.62 **Forming** — Rough shaping the stock into a 'use' preparatory to the final forging operation.

2.63 **Fraze** — A rough edge along the flash line after clipping.

2.64 **Fuller** — That part of the die used to reduce a portion of the stock to the appropriate form of the forging.

2.65 Gate — The clearance cut in the front of a die to accommodate the bar undergoing forging and to retain a connection between the bar and the forging.

2.66 Gathering — Increasing the cross section of the stock beyond the original size.

2.67 Ghost — A segregated streak, usually containing a concentration of sulphide, phosphide, oxide, etc, lower in carbon than the surrounding material (*see also* **2.102**).

2.68 Goethic Section — A rolled or forged product having approximately square section. The dimensions are specific with specified radius or chamfer at corners without any concavity on the sides.

2.69 Gutter — A recess surrounding the impression in the die face, to receive excess metal beyond the fash proper.

2.70 Hair Line Cracks (Flakes) — Internal ruptures in steel caused by stresses which probably arise from the combination of several factors such as volume changes due to transformation, brittleness due to the presence of hydrogen and the arrangement of the microstructure resulting from hot working. The size of such ruptures may vary considerably, but they are usually comparatively short in length when viewed on a surface cut at right angles to the plane of defect, and generally are so fine that they cannot be discerned other than after etching or by magnetic crack detection.

2.70.1 *Snowflakes* — When hairline cracks are exposed by fracturing, they appear as bright crystalline areas of almost circular form, sometimes known as snowflakes.

2.71 Hammer Cogging — *See* **2.24**.

2.72 Heat — A period of forging before further reheating is necessary.

2.73 Hollow Forging — Forging a tube, ring or drum on a becking bar or mandrel.

2.74 Hollow Punching — *See* **2.150**.

2.75 Inclusions (Non-metallic Inclusions) — Particles of oxides, silicates, sulphides, refractories, etc, embedded in the metal. These are products of deoxidation.

2.76 Ingot — Casting of suitable shape and size intended for subsequent hot working.

2.77 Ingot Corner Segregation — A longitudinal plane of relatively impure steel arising from a segregation occurring in the region of a corner of an ingot.

2.78 Insert — A piece of steel permanently fixed in the die, which may be used to fill a cavity or to replace a portion or the whole of the impression.

2.79 Inverse Segregation — *See* 2.128.

2.80 Jumping — *See* 2.154.

2.81 Key — A wedge used for fastening the dies into the hammer tup or into the anvil block.

2.82 Lamination — A defect in rolled materials, characterized by a tendency to split into layers along the direction of rolling usually due to the presence of non-metallic inclusions or other discontinuity in the steel.

2.83 Lap (Overlap; Shut) — A surface defect caused by the folding of a metal surface against itself.

2.84 Leave — *See* 2.39.

2.85 Lock (Step) — One or more changes in the plane of the die faces.

2.86 Loose Tool — A tool or die, manipulated by the forgeman, used in conjunction with fixed top or bottom tools of the press or hammer to shape a forging.

2.87 Loose Tool Forging — A forging made with loose tools.

2.88 Mandrel — A round bar, usually slightly tapered, inserted through the forging and not supported at the ends, and around which a tube, ring or drum is forged between the upper and lower tools of the hammer or press. The mandrel governs the internal diameter.

2.89 Middle — A part of a forging at each end of which is a length of larger section.

2.90 Middling — Forging the middle of an ingot or billet as a first operation; also finishing the middle of a forging before either end.

2.91 Mis-match — *See* 2.96.

2.92 Neck — A part of a forging which adjoins a collar or barrel and is of smaller cross section.

2.93 Necking — Forming a groove in the bar to set off the amount of material required to make one forging.

2.94 Negative Segregation — *See* 2.128.

2.95 Non-metallic Inclusions — *See* 2.75.

2.96 Offset (Mis-match) — A fault caused by the misalignment of the impressions in top and bottom dies.

2.97 Overheating — Heating to such a high temperature that an undesirably coarse grained structure is produced. Severe overheating may result in the properties being permanently impaired.

2.98 Overlap — *See* **2.83.**

2.99 Over-pickled — Pickled longer than necessary resulting in pronounced chemical attack causing pitting and roughness on the surface.

2.100 Parting Line (Die Line) -- The dividing plane between the faces of a pair of dies.

2.101 Peg (Stopper) — A block placed to keep the forging tools at a minimum distance.

2.102 Phosphide Streak — An elongated area of segregated phosphide which is revealed on etching.

2.103 Pickling — The removal of scale by chemical or electrochemical treatment with dilute acids or other chemicals, followed by washing.

2.104 Piercing — Making a hole with a tapered and pointed tool without removal of metal.

2.105 Pipe (Contraction Cavity; Shrinkage Cavity) — An axial cavity caused by contraction during solidification of an ingot. Also the defect arising from the axial cavity in semi-finished or finished products. It may also refer to tubular products.

2.106 Plate — A loose tool used for plating, that is, for reducing a forging locally to produce a neck, middle, etc.

2.107 Plating

a) Forging in such a manner that there is a greater movement of metal transversely than in the longitudinal direction (applies to drop forging).

b) *See* **2.106.**

2.108 Porter Bar (Box; Staff) — The tool used to hold the ingot or bloom during forging.

2.109 Press Forging — A forging produced between closed dies in a mechanical or hydraulic press.

2.110 Pull — An irregular transverse crack on the face of an ingot caused by restriction to free contraction during cooling in a mould.

2.111 Punch

a) The blunt tool used for piercing a hole through a forging.

b) The upper or moving member of the clipping tools used for removing fash from drop forgings.

2.112 **Punching** — Making a hole in a forging by removing a disc of metal with a blunt nosed tool.

2.113 **Reheating** — Heating steel to a uniform temperature in readiness for hot working.

2.114 **Restriking (Tapping)** — Correcting distortion by giving a light blow to the drop forging after clipping.

2.115 **Roak** — *See* 2.116.

2.116 **Roke (Roak)** — A longitudinal surface defect caused by a blowhole which has perforated the surface and become oxidized, or by an inclusion at the surface.

2.117 **Rolling** — Preparing a cylindrical forging or 'use' by rounding stock between swaging tools prior to drop forging.

2.118 **Rolling Off** — Removing the sharp edges of the die impression so as to allow the metal to flow readily.

2.119 **Roughing** — *See* 2.24.

2.120 **Rumbling** — Tumbling forgings in a rotating barrel to remove scale.

2.121 **Saddening** — A light forging operation preparatory to reheating for heavier reduction.

2.122 **Saddle** — *See* 2.6.

2.123 **Scab** — *See* 2.130.

2.124 **Scale** — Oxide formed on the surface of steel or iron after heating under oxidizing conditions.

2.125 **Scarfing** — *See* 2.31.

2.126 **Scrap** — *See* 2.49.

2.127 **Seam** — Shallow groove or striation formed by the elongation of oxidized surface or subsurface blowholes.

2.128 **Segregation** — A non-uniform distribution of some constituents and/or impurities in a cast product, characterized by the mode of solidification of alloys. Segregation usually persists through subsequent hot and cold working. Generally the concentration of low melting constituents tend to be higher in the centre than the surface. Sometimes, the reverse of this phenomenon takes place and is known as 'inverse segregation' or 'negative segregation'.

2.129 **Setter** — *See* 2.7.

2.130 **Shell (Scab; Sliver; Spill)** — A relatively thin film or tongue of metal imperfectly attached to the surface of steel. The defect on the sides of the ingot caused by metal splashes during teeming, the splashes having solidified and stuck to the mould wall, is also called shell.

2.131 Shot Blasting — Removal of scale by the high speed impact of metal shot.

2.132 Shrinkage Cavity — *See* 2.105.

2.133 Shut — *See* 2.83.

2.134 Sizing — A general term applied to a cold work operation to bring the job to exact dimensions (*see also* 2.25).

2.135 Sliver — *See* 2.130.

2.136 Slug — A short piece of bar or billet sufficient to make one forging.

2.137 Snowflakes — *See* 2.70.1.

2.138 Soaking — Holding the material in a furnace after the outside has reached the desired temperature until uniformity of that temperature has been reached throughout its mass and any desired metallurgical changes have been completed.

2.139 Spalling — The flaking off of small particles of metal from the surface of a bar, billet or any component in service or in processing.

2.140 Spill — *See* 2.130.

2.141 Spreading — Forging in such a manner that there is a movement of metal greater in the transverse than in the longitudinal direction.

2.142 Staff — *See* 2.108.

2.143 Step — *See* 2.85.

2.144 Stock — The portion, cut from a bar or billet, required to make a given number of forgings.

2.145 Stopper — *See* 2.101.

2.146 Swaging — Making a forging of circular section between specially shaped concave tools.

2.147 Taper — *See* 2.39.

2.148 Tapping — *See* 2.114.

2.149 Tong Hold — *See* 2.2.

2.150 Trepanning (Hollow Punching) — Removing a core from a piece of steel either by machining with a tubular cutter or by hollow punching, that is, by pressing a hollow punch through the hot steel.

2.151 Trimming — *See* 2.22.

2.152 Twisting — Torsional displacement of parts of a forging as in the manufacture of a crankshaft.

2.153 Upend Forging — A forging produced in closed dies so that the direction of the grain flow is largely at right angles to the die faces.

2.154 Upending (Jumping; Upsetting) — Hot working to shorten the axial length and increase the cross-sectional area.

2.155 Upsetting — *See* 2.154.

2.156 Use — A partly formed drop forging.

2.157 Wad — A thin web of metal which is punched out to produce a hole through the forging.

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TO

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PART 6 FORGING (INCLUDING DROP FORGING)

(*First Revision*)

(*Page* 4, *clause* 2.1, *first sentence*) Substitute the following for the existing first sentence:

'2.1 *Bar* - Finished product of solid section generally supplied in straight length, which may be rectangular, square, round or half round, or polygonal.'

(SMDC 1)

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PART 6 FORGING (INCLUDING DROP FORGING)

(*First Revision*)

[*Page* 4 *clause* **2.1** (*see also Amendment No.* 1)] — Substitute the following for the existing:

'**2.1 Bar and Rod** — Finished product of solid section generally supplied in straight length, which may be rectangular, square, round or half round, or polygonal. The bars may be supplied in coil form also. The dimensions generally conform to the following (*see also* **2.1.1**):

a) *Rounds and Half-Rounds* — Minimum diameter 5 mm.

b) *Squares and Polygonal* — Minimum side 6 mm.'

(SMDC 1)

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